

# **AIR FORCE QUALIFICATION TRAINING PACKAGE (AFQTP)**



for  
**ELECTRICAL POWER PRODUCTION**  
**(3E0X2)**

**MODULE 28**  
**GENERATOR SET OPERATION**

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Career Field Education and Training Plan (CFETP) references from 1 Apr 97 version.

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**Notice.** This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

**AIR FORCE QUALIFICATION TRAINING PACKAGES**  
**for**  
**ELECTRICAL POWER PRODUCTION**  
**(3E0X2)**

**INTRODUCTION**

*Before starting this AFQTP*, refer to and read the “Trainee/Trainer Guide” located on the AFCESA Web site <http://www.afcesa.af.mil/>

*AFQTPs are mandatory and must be completed* to fulfill task knowledge requirements on core and diamond tasks for upgrade training. *It is important for the trainer and trainee to understand* that an AFQTP does not replace hands-on training, nor will completion of an AFQTP meet the requirement for core task certification. AFQTPs will be used in conjunction with applicable technical references and hands-on training.

*AFQTPs and Certification and Testing (CerTest) must be used as minimum upgrade requirements for Diamond tasks.*

**MANDATORY minimum upgrade requirements:**

***Core task:***

AFQTP completion  
Hands-on certification

***Diamond task:***

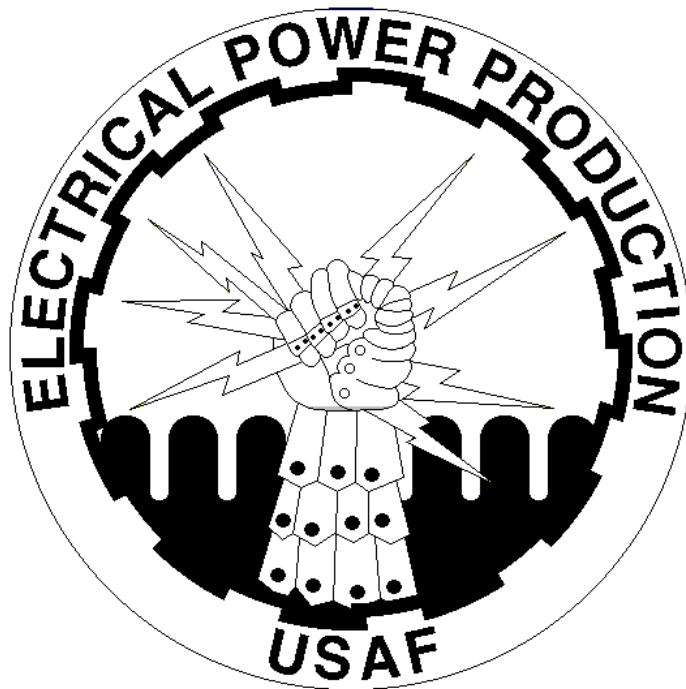
AFQTP completion  
CerTest completion (80% minimum to pass)

***Note:*** *Trainees will receive hands-on certification training for Diamond Tasks when equipment becomes available either at home station or at a TDY location.*

***Put this package to use.*** Subject matter experts under the direction and guidance of HQ AFCESA/CEOT revised this AFQTP. If you have any recommendations for improving this document, please contact the Electrical Power Production Career Field Manager at the address below.

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## GENERATOR SET OPERATION

MODULE 28

AFQTP UNIT 8

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### MAINTAIN POWER PLANT DOCUMENTATION (28.8.)

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**MAINTAIN POWER PLANT DOCUMENTATION*****Task Training Guide***

<b>STS Reference Number/Title:</b>	28.8., Maintain Power Plant Documentation
<b>Training References:</b>	<ul style="list-style-type: none"> <li>• Electric Power Plant and Generators</li> <li>• 35C2 Series Technical Orders</li> <li>• Manufacturer's Manuals</li> <li>• Local procedures</li> </ul>
<b>Prerequisites:</b>	<ul style="list-style-type: none"> <li>• Possess a 3E032 AFSC</li> </ul>
<b>Equipment/Tools Required:</b>	<ul style="list-style-type: none"> <li>• AF Forms 487, 719, 731, 734, 1167, 3507, 3508, 3509, or 3510</li> <li>• Personal protective equipment</li> <li>• Technical and manufacturer's manuals</li> </ul>
<b>Learning Objective:</b>	<ul style="list-style-type: none"> <li>• Enter and maintain documentation for power plant operation and maintenance.</li> </ul>
<b>Samples of Behavior:</b>	<ul style="list-style-type: none"> <li>• Trainee will determine the required documentation for power plant operation and maintenance.</li> <li>• Trainee will maintain the documentation for power plant operation and maintenance.</li> </ul>
<b>Notes:</b>	
<ul style="list-style-type: none"> <li>• The documentation for power plant operation and maintenance is determined by the MAJCOM Functional Manager and the applicable Technical and Manufacturer's manuals. The AF Forms covered in this AFQTP are simple to complete and maintain if the instructions printed on the form are followed.</li> </ul>	

**Notice.** This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

## MAINTAIN POWER PLANT DOCUMENTATION

**Background:** Power plant documentation varies from plant to plant, Major Command (MAJCOM) to MAJCOM, and even state to state. Whether the plant is standby or prime, composed of MEP-012s or caterpillars, or fueled by diesel or turbine power, this has a bearing on the type and extent of documentation. State and local environmental laws may pose special requirements, therefore you should contact your base environmental section for these concerns. For Air Force and MAJCOM forms, you will have to rely heavily on local procedures and your MAJCOM functional manager for guidance on the documentation requirements for your plant. This AFQTP focuses on the documentation required in AFI 36-1062, Electrical Power Plants and Generators.

Good record keeping is essential to effective equipment analysis. Base electrical power production personnel and maintenance engineers maintain and analyze the operation and maintenance records of power plants to ensure the mission receives reliable electrical support and that the equipment follows minimum life-cycle cost trends. Follow your major command policy for determining who gets distribution of power plant records, when they review the records, and how the reviewer provides feedback to base personnel. Consult administrative personnel on the procedures for the maintenance and disposal of records. Now, let's take a look at some of the different types of documentation involved in the operation and maintenance of Air Force power plants.

**Power Plant Operating Logs.** Generator operating logs record the system's performance during regular operation, inspections, and testing. AFI 32-1062 requires the operator to document each scheduled generator run at prime power plants, each scheduled emergency generator exercise, and all unscheduled power outages on an approved form. Only one form is necessary for each event and each generator. A completed copy should be maintained where operations and maintenance personnel can find it easily and another copy at the plant or generator unit. One of the following forms (as determined by your MAJCOM) can be used to satisfy this requirement:

**AF Form 487:** Emergency Generator Operating Log (Inspection and Testing). The AF Form 487 or another MAJCOM-approved form will be used for standby power plants, Real Property Installed Equipment (RPIE) generators and Equipment Automated Inventory Data (EAID) generators requiring bi-hourly monitoring. Record the following information as a minimum:

- Operating data
- Condition of lube oil (viscosity test)
- Condition of plant and subsystems
- Deficiencies
- Corrective measures

**AF Form 1167:** Daily Power Plant Operating Log (Diesel - Electric). This form is for prime power plants and if the running time for standby power plants exceeds 8 continuous hours.

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**AF Form 3509:** Daily Power Plant Operating Log (Gas Turbine - Electric) is for steam and gas turbine power plants.

A custom log can be developed and used when the standard log is inadequate or not available. This custom log must be approved by your MAJCOM and a copy forwarded to HQ AFCEA/CESE identifying what improvements you made as a result of this local log.

**Maintenance Records.** You should record maintenance data during inspections and maintenance that measure equipment condition and wear rates. This data should be reviewed periodically to help identify problem trends and to enhance the scheduling of maintenance activities. The following forms can be used to record the maintenance and inspection data as directed by your MAJCOM and Air Force Instruction:

- **AF Form 731**, Crankshaft Deflection Record
- **AF Form 734**, Cylinder Liner and Ring Wear Record
- **AF Form 3507**, Diesel Engine Inspection Data
- **AF Form 3508**, Diesel Cylinder Compression and Firing Tests
- **AF Form 3510**, Automatic Transfer Switch Inspection/Maintenance Report

**Analyzing Performance.** By monitoring engine performance data you can detect gradual changes that signal engine deterioration. If you plot this essential data versus time to graphically reveal performance trends, it can enhance the scheduling of equipment maintenance, increase equipment reliability, and minimize system downtime caused by unscheduled maintenance. You must include, as a minimum, the following data to plot: compression pressure, cylinder firing pressure, exhaust temperature, crankcase pressure (vacuum), lube oil consumption, and fuel consumption.

**Power Plant Log Book.** In addition to the *AF Form 1167*, you should maintain a log book at each power plant to enter other pertinent information. Use this log to record the time of events, nature of abnormalities and malfunctions, physical measurements taken, adjustments made, oil samples taken, oil changed, maintenance performed, and weather information.

**Historical Records.** An *AF Form 719*, Historical Record Diesel Electric Generators and System, should be maintained by the maintenance organization for each RPIE and EAID generator. Use it to show the date, the cumulative number of engine operating hours, a description of all maintenance and inspections, and parts replaced. When transferring a generator set from one organization to another, send the associated historical records with it. This will provide the gaining organization with the background information necessary to properly maintain their new asset.

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*To Perform the task, follow these steps:*

**Step 1: Determine required documentation.**

This step requires you to contact your MAJCOM functional manager and find out what your MAJCOM requires for power plant documentation. You may also want to review the Inspector General Plan (checklist) and see what they will be looking for during their inspections. Remember, you can always exceed Air Force and MAJCOM requirements and use additional graphs and forms if they will enhance your operation and maintenance.

**Step 2: Complete required operations records.**

Once you determine the required operating form and/or log, you need to complete the form according to the applicable 37-series instruction and prescribing directive. The most commonly used operating forms are as follows:

**AF Form 487:** Emergency Generator Operating Log (Inspection and Testing). The completion of this form is self-explanatory and has the instructions written directly on the form.

**AF Form 1167:** Daily Power Plant Operating Log (Diesel - Electric). Again, this form is self-explanatory and has the instructions printed on the form.

**AF Form 3509:** Daily Power Plant Operating Log (Gas Turbine - Electric). This form is a user friendly form and can be easily completed by following the instructions on the form.

A custom log developed and used at your location must include as a minimum: Operating data, condition of lube oil (viscosity test), condition of plant and subsystems, deficiencies, and corrective measures taken.

**Step 3: Complete required maintenance records.**

Record generator system data taken during inspections and maintenance that measure the equipment condition and wear rates. This data, if used properly, will help identify problem trends and enhance the scheduling of maintenance activities. The completion of these forms is self-explanatory and easy if the instructions, printed on the form, are followed. MAJCOM Functional Managers determine which of the following forms you will use at your location:

- **AF Form 731**, Crankshaft Deflection Record
- **AF Form 734**, Cylinder Liner and Ring Wear Record
- **AF Form 3507**, Diesel Engine Inspection Data
- **AF Form 3508**, Diesel Cylinder Compression and Firing Tests
- **AF Form 3510**, Automatic Transfer Switch Inspection/Maintenance Report
- **AF Form 719**, Historical Record Diesel Electric Generators and Systems

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**Step 4: Distribute power plant documentation.**

According to AFI 32-1062, your administrative specialist and MAJCOM Functional Manager can provide you with the distribution and disposition instruction of power plant documentation. Most MAJCOMs want the last daily AF Form 1167 for each generator for each month and the originals remain in the power plant as historical records. Most other power plant documentation remains with the section having operation and maintenance responsibility.

**HINT:**

Power plant documentation is only of value if you analyze the data and take the appropriate action.

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## Review Questions for Maintain Power Plant Documentation

Question	Answer
1. Power plant documentation is standard for all power plants throughout the Air Force?	a. True b. False
2. Why is good record keeping essential to equipment analysis?	a. For reliable electrical support and show maintenance trends b. Detect gradual changes that will signal engine deterioration c. Eliminate the need for unscheduled maintenance d. Both a and b
3. What is the importance or reason for maintaining generator operating logs?	a. Record performance during operation, inspection, and testing b. Determine the need for additional generators c. Provide customer feedback d. All of the above
4. Which form is used for standby plants or RPIE and EAID generators requiring bi-hourly monitoring?	a. AF Form 731, Crankshaft Deflection Record b. AF Form 1167, Daily Power Plant Operating Log c. AF Form 487, Emergency Generator Operating Log d. AF Form 734, Cylinder Liner and Ring Wear Record
5. Which form should be maintained for each RPIE and EAID generator for the purpose of documenting engine hours and maintenance performed?	a. AF Form 719, Historical Record Diesel Electric Generators b. AF Form 487, Emergency Generator Operating Log c. AF Form 1167, Daily Power Plant Operating Log d. AF Form 731, Crankshaft Deflection Record

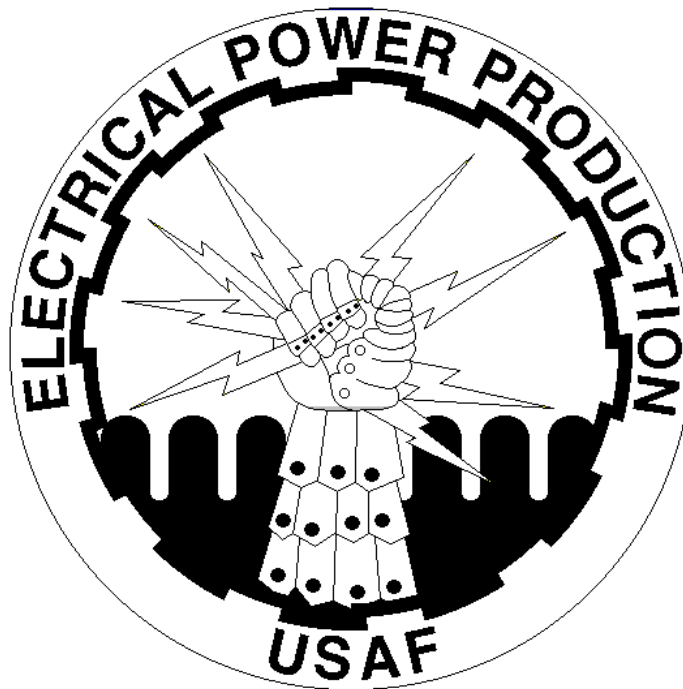
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**MAINTAIN POWER PLANT DOCUMENTATION**

<b>Performance Checklist</b>		
<b>Step</b>	<b>Yes</b>	<b>No</b>
1. Determined required documentation		
2. Completed required operations records		
3. Completed required maintenance records		
4. Distributed power plant documentation		

**FEEDBACK:** Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

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## GENERATOR SET CABLES

**MODULE 28**

**AFQTP UNIT 9**

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**CONNECT (28.9.1)**

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**CONNECT*****Task Training Guide***

<b>STS Reference Number/Title:</b>	28.9.1., Connect
<b>Training References:</b>	<ul style="list-style-type: none"> <li>• 35C2 series Technical Order</li> <li>• Manufacturer's manual</li> <li>• Local procedures</li> </ul>
<b>Prerequisites:</b>	<ul style="list-style-type: none"> <li>• Possess a 3E032 AFSC</li> <li>• Use hand tools</li> <li>• Read schematic diagrams</li> </ul>
<b>Equipment/Tools Required:</b>	<ul style="list-style-type: none"> <li>• General tool kit</li> <li>• Applicable technical references</li> <li>• Personal safety equipment</li> </ul>
<b>Learning Objective:</b>	<ul style="list-style-type: none"> <li>• Demonstrate steps required to safely connect load leads to a generator set.</li> </ul>
<b>Samples of Behavior:</b>	<ul style="list-style-type: none"> <li>• Trainee will be able to determine if it is safe to install load leads to the generator.</li> </ul>
<b>Notes:</b>	
<ul style="list-style-type: none"> <li>• To successfully complete this element follow the steps outlined in the applicable technical manual exactly--no exceptions.</li> <li>• Any safety violation is an automatic failure.</li> </ul>	

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## CONNECT

**Background:** Generators can be connected in many different configurations, each requiring load cables (refer to Figure 1). There are also many types of cable connectors/ends, including: load break, quick disconnects and pig tails just to name a few. Due to the high voltage (4160 VAC) produced by the MEP-012A generator set, exterior electricians are primarily responsible for connecting and disconnecting the load breaks, but power production personnel may be required to assist and/or perform this task once certified. As a electrical power production specialist, you are required to perform all aspects of connecting and disconnecting generator load cables for circuits less than 4160 VAC. This lesson will concentrate on a single unit facility installation.

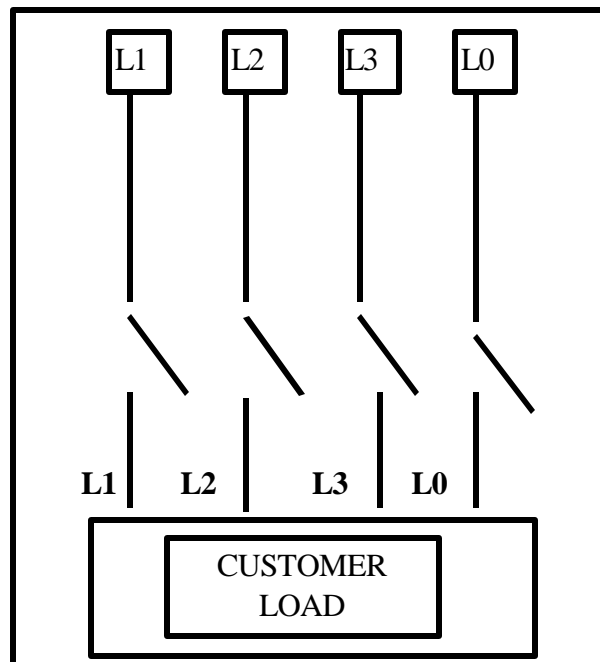


FIGURE 1, LOAD CONNECTION.

*Observe the following steps when connecting/disconnecting load breaks:*

**Step 1: Gather required information.**

When ever you are tasked to provide generator power, it is imperative you determine the Following:

What size cable? How many phases? What voltage? What KW generator? These questions are just a few of the questions you need to ask to effectively support the endeavor you have been task to perform.

**Step 2: Gather required equipment.**

Having the proper equipment (and in working order) will save you time by preventing you from going back to the shop for the tool you forgot. A general tool box, to including a multimeter, a

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phase rotation meter and proper technical reference are a good start. Bring along other useful items you may think of.

**NOTE:**

A MEP 007A was used to perform the following steps:

**Step 3: Connect load cables to load terminal board and facility (load).**

- Ensure the unit is properly shut down and the DC Circuit Breaker (CB1) is pulled out.
- Open the access door to the generator compartment and carefully remove the safety cover from the load terminal board.

**SAFETY:**

1. **LETHAL VOLTAGES ARE PRESENT AT THE LOAD TERMINAL BOARD OF THE GENERATOR SET DURING OPERATION. DO NOT ATTEMPT TO CONNECT OR DISCONNECT LOAD LEADS WHILE THE GENERATOR SET IS OPERATING. DO NOT ATTEMPT TO CONNECT OR DISCONNECT LOAD LEADS WITH THE GENERATOR SET SHUT DOWN AND THE LOAD CONNECTED TO ANOTHER POWER SOURCE, OR WHILE THE GENERATOR SET IS IN PARALLEL TO ANOTHER UNIT WHICH IS OPERATING.**
2. **NEVER RUN CABLES THROUGH THE GENERATOR ACCESS DOORS. IT DOES NOT ALLOW PROPER AIR FLOW FOR COOLING THE UNIT. A DIRECT SHORT TO GROUND WILL OCCUR SHOULD THE PANEL DOOR CUT THROUGH THE INSULATION.**
3. **WEAR SAFETY GLOVES WHEN HANDLING CABLES.**

**HINT:**

1. Cables may be marked with “bands” of tape to indicate phases, or may have the phases stenciled on the cable.
2. The load terminals will accommodate 2-wire single phase and 4-wire, 3 phase loads. One or more single phase loads can be served alone or in combinations with 3 phase loads; but the load on any one phase must not exceed 100 percent of the current rating of that phase.

Insert load leads through the plate and sleeve assembly and connect as follows:

- Connect the cable marked “L1” to the load terminal marked “L1”
- Connect the cable marked “L2” to the load terminal marked “L2”
- Connect the cable marked “L3” to the load terminal marked “L3”
- Connect the cable marked “L0” to the load terminal marked “L0”
- Tighten the terminal binding nuts with the plastic/phenolic box end wrench and install the safety cover.
- Ensure the voltage reconnection board is set to the proper voltage.
- You are now ready to supply electrical power to the load.
- MEP series generators will have a clockwise phase rotation if you connect the red lead to L1, white lead L2 and blue lead L3 of the phase rotation meter to the generator lugs as indicated.

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**Step 4: Properly Ground the generator.**

Install adequate ground rod and connect correct size grounding conductor from rod to generator grounding lug

**Step 5: Connect cables to facility isolation switch (double throw).**

Determine power is deenergized on the generator input lugs of the double throw panel

Use caution when working in the double throw panel because the line side (commercial power input) may be energized

**Step 6: Check for proper phase rotation of facility**

Connect phase rotation meter leads to input lug of double throw panel

Red lead to lug on left, white lead to center lug, blue lead to right lug

Take rotation reading of commercial power

If generator output is the same as commercial your installation is complete

If phase rotation is incorrect alternate any two conductors in the double throw panel and retake rotation reading.

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**Review Questions  
for  
Connect**

Question	Answer
1. You have been tasked to install a generator at bldg.111. What is the first thing you should do?	a. Ground the generator. b. Verify the load requirements. c. Verify the voltage and phase requirements. d. Both b&c.
2. What step must be taken prior to connecting leads to the load terminal board of a MEP 007A?	a. Install safety cover b. Warm up generator c. Remove safety cover d. Tighten lug with phenolic/ plastic wrench
3. Load cables should always be installed through generator access doors.	a. True b. False
4. It is safe to install MEP 007 load cables by hand if generator is off.	a. True b. False
5. You have just finished installing the load cables between the generator and the facility, what should be your next step?	a. Chalk the generator set b. Determine load c. Check for proper phase sequence d. Warm-up the generator set

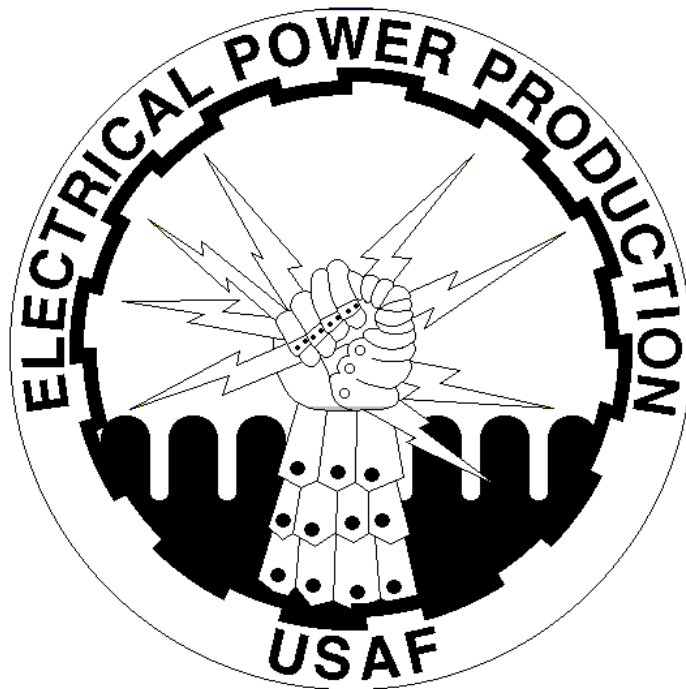
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## CONNECT

Performance Checklist		
Step	Yes	No
1. Gathered required equipment		
2. Ensured load terminals were de-energized		
3. Connected load cables to load terminal board		
4. Ensured output terminals were de-energized		
5. Connected load cables to output terminals		

**FEEDBACK:** Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

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## GENERATOR SET CABLES

MODULE 28

AFQTP UNIT 9

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### DISCONNECT (28.9.2)

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**DISCONNECT*****Task Training Guide***

<b>STS Reference Number/Title:</b>	28.9.2., Disconnect
<b>Training References:</b>	<ul style="list-style-type: none"> <li>• 35C2 series Technical Order</li> <li>• Manufacturers Manual</li> <li>• Local Procedures</li> </ul>
<b>Prerequisites:</b>	<ul style="list-style-type: none"> <li>• Possess a 3E032 AFSC</li> <li>• Use hand tools</li> </ul>
<b>Equipment/Tools Required:</b>	<ul style="list-style-type: none"> <li>• General tool kit</li> <li>• Applicable Technical references</li> <li>• Personal safety equipment</li> </ul>
<b>Learning Objective:</b>	<ul style="list-style-type: none"> <li>• Determine steps required to safely disconnect load leads from a generator set.</li> </ul>
<b>Samples of Behavior:</b>	<ul style="list-style-type: none"> <li>• Trainee will be able to ensure power is deenergized.</li> <li>• Trainee will disconnect load leads from the generator set.</li> </ul>
<b>Notes:</b>	
<ul style="list-style-type: none"> <li>• To successfully complete this element follow the steps outlined in the applicable technical manual exactly--no exceptions.</li> <li>• Any safety violation is an automatic failure.</li> </ul>	

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## DISCONNECT

To properly disconnect load leads from a generator set, follow the steps below:

### Step 1: Gather required equipment.

Having the proper equipment (and in working order) will save time going back to the shop. A general tool box, including a multimeter and proper technical reference are a good start. Bring along other useful items you may think of.

#### NOTE:

A MEP 007A was used to illustrate the following steps.

### Step 2: Ensure load terminals are de-energized.

- Ensure the unit is properly shutdown and the DC Circuit Breaker (CB1) is pulled out.
- Open the access door to the generator compartment and carefully remove the safety cover from the load terminal board.
- With a multimeter (checking for phase and line voltage), ensure no voltage is present at the load terminals.

#### SAFETY:

**LETHAL VOLTAGES ARE PRESENT AT THE LOAD TERMINAL BOARD OF THE GENERATOR SET DURING OPERATION. DO NOT ATTEMPT TO CONNECT OR DISCONNECT LOAD LEADS WHILE THE GENERATOR SET IS OPERATING. DO NOT ATTEMPT TO CONNECT OR DISCONNECT LOAD LEADS WITH THE GENERATOR SET SHUT DOWN AND THE LOAD CONNECTED TO ANOTHER POWER SOURCE, OR WHILE THE GENERATOR SET IS IN PARALLEL TO ANOTHER UNIT WHICH IS OPERATING.**

### Step 3: Disconnect load cables from the generator load terminal board

- Disconnect the load cable using the phenolic/plastic wrench from the terminal board.
- Re-install the safety cover.
- Pull the cable out and away from the generator.
- Close access door.

### Step 4: Ensure power is deenergized on generator input side of double throw panel

Remove generator cables from double throw panel

### Step 5: Perform general housekeeping tasks to provide a safe working area

Prepare the area for the next power outage to make installation quick and safe for any future requirements

#### SAFETY:

**WEAR SAFETY GLOVES WHEN HANDLING CABLES.**

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**Review Questions  
for  
Disconnect**

<b>Question</b>	<b>Answer</b>
1. Who is primarily responsible for connecting and disconnecting the load cables at EAID sites?	a. Power Pro. personnel b. First person available c. Exterior electricians d. Control specialist
2. What must be verified prior to disconnecting the load leads?	a. The unit is shut down b. Load terminals are energized c. Load terminals are de-energized d. a & c
3. When is it safe to disconnect load cables when the unit is operating?	a. When the unit is below 50% rated amps b. When the unit is below 10% rated load c. When the unit is in parallel a. It is never safe
4. What two types of checks are made to ensure the load terminals are not energized on a MEP-007A?	a. Phase and Line b. Phase and Wye c. Phase and Delta a. None of the above

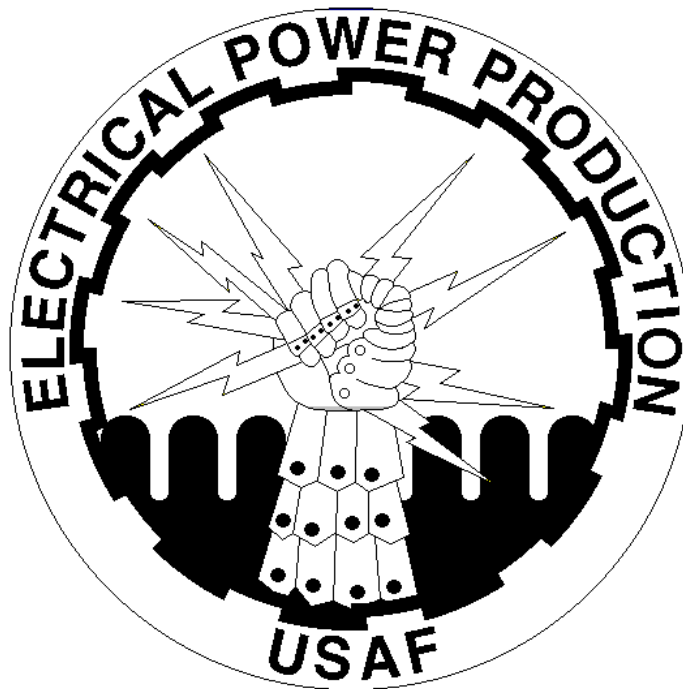
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**DISCONNECT**

Performance Checklist		
Step	Yes	No
1. Gathered required equipment		
2. Ensured load terminals were de-energized		
3. Disconnected load cables to load terminal board		
4. Ensured output terminals were de-energized		
5. Disconnected load cables to output terminals on a MEP 012		
6. Adhered to all safety tips procedures		

**FEEDBACK:** Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

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## GENERATOR SET CABLES

**MODULE 28**

**AFQTP UNIT 9**

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### CHECK PHASE ROTATION (28.9.3)

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## CHECK PHASE ROTATION

### *Task Training Guide*

<b>STS Reference Number/Title:</b>	28.9.3., Check Phase Rotation
<b>Training References:</b>	<ul style="list-style-type: none"> <li>• CD-ROM Power Production Test Equipment Course 12.4</li> <li>• 35C2 series Technical Order</li> <li>• Manufacturers Manual</li> <li>• Local Procedures</li> </ul>
<b>Prerequisites:</b>	<ul style="list-style-type: none"> <li>• Possess a 3E032 AFSC</li> </ul>
<b>Equipment/Tools Required:</b>	<ul style="list-style-type: none"> <li>• General Tool Kit</li> <li>• Phase Rotation Meter</li> <li>• Personal safety equipment</li> </ul>
<b>Learning Objective:</b>	<ul style="list-style-type: none"> <li>• Trainee will be able to safely determine the phase sequence of the generator and equipment.</li> </ul>
<b>Samples of Behavior:</b>	<ul style="list-style-type: none"> <li>• Trainee will demonstrate the use of the phase rotation meter.</li> </ul>
<b>Notes:</b>	
<ul style="list-style-type: none"> <li>• To successfully complete this element follow the steps outlined in the applicable technical manual exactly--no exceptions.</li> <li>• Any safety violation is an automatic failure.</li> </ul>	

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### CHECK PHASE ROTATION

**Background:** Generators used in power production have markings (L1, L2, L3, and L0) that indicate the order in which the generator provides power--phase sequence. The power produced by the generator must be properly connected to the load. Therefore, personnel must insure that generators are connected to the load in accordance with the needs of that load.

For example, a three phase motor that requires a 1- 2- 3 phase sequence (for clockwise rotation), will either rotate in a counterclockwise direction or may not operate at all if it receives 3-2-1 phase sequence power. If the example was a building on base, the heating and refrigeration units, compressors, etc., would be operating backwards. This could be a very costly mistake with possible damage to equipment and personnel.

*To perform these tasks, complete:* CD-ROM Power Production Test Equipment Course 12.4

**NOTE:** In the CD-ROM there are tests after each section. Complete each section and answer the questions.

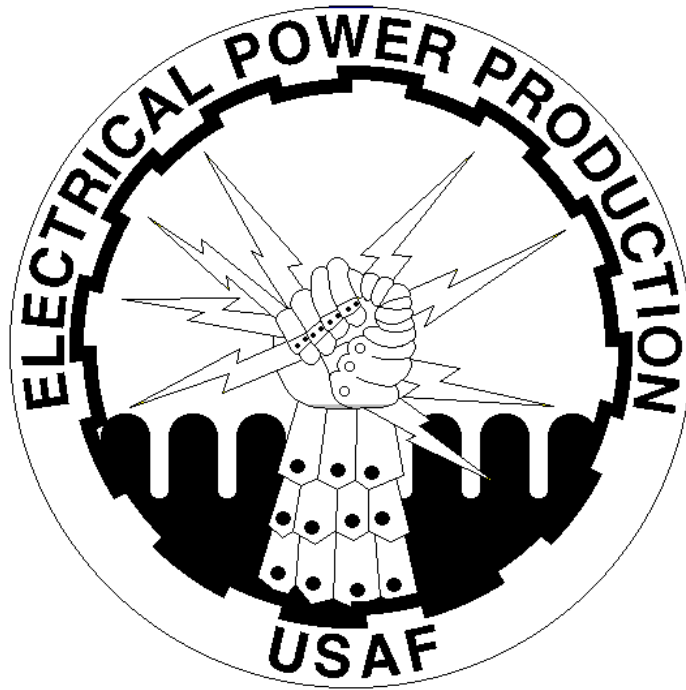
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**CHECK PHASE ROTATION**

Performance Checklist		
Step	Yes	No
1. Determined phase sequence?		
2. Determined phase rotation?		
3. Used phase rotation meter?		
4. Adhered to all safety tips?		

**FEEDBACK:** Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

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## GENERATOR SET OPERATION

MODULE 28

AFQTP UNIT 10

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### TEST GENERATOR SETS USING LOAD BANK (28.10.)

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**TEST GENERATOR SETS USING LOAD BANK*****Task Training Guide***

<b>STS Reference Number/Title:</b>	28.10., Test Generator Sets Using Load Bank
<b>Training References:</b>	<ul style="list-style-type: none"> <li>• 35C2 series Technical Orders</li> <li>• Manufacturer's Manuals</li> <li>• Local Procedures</li> </ul>
<b>Prerequisites:</b>	<ul style="list-style-type: none"> <li>• Possess a 3E032 AFSC</li> </ul>
<b>Equipment/Tools Required:</b>	<ul style="list-style-type: none"> <li>• General tool box</li> <li>• Personal safety equipment</li> </ul>
<b>Learning Objective:</b>	<ul style="list-style-type: none"> <li>• Demonstrate steps on testing generator sets using a load bank.</li> </ul>
<b>Samples of Behavior:</b>	<ul style="list-style-type: none"> <li>• The trainee will position, ground, operate, and shut down a load bank.</li> <li>• The trainee will know the maintenance requirements for the load bank.</li> </ul>
<b>Notes:</b>	
<ul style="list-style-type: none"> <li>• To successfully complete this element follow the steps outlined in the applicable technical manual exactly--no exceptions.</li> <li>• Any safety violation is an automatic failure.</li> </ul>	

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## TEST GENERATOR SETS USING LOAD BANK

**Background:** The information presented in this AFQTP was primarily extracted from the Avtron Model K375 load bank instruction manual. The load bank is an air cooled, balanced three phase resistive load which may be operated at either 120/208 or 240/480 VAC. It can provide the generator rated load to minimize carbon buildup and other malfunctions associated with operating generators with light load (less than 25%). Maintenance of the load bank includes:

**To perform these tasks, complete.**

### Step 1: Position the load bank.

The load bank must be used in a cool, well ventilated area where cool air is continually available and hot exhaust air will not be recirculated through the load bank. Exhaust temperature can reach 280 degrees F. in approximately three minutes without the proper ventilation. Any obstruction located within eight feet of the inlet and exhaust louvers will restrict the load bank's airflow. The wind can work for or against the load bank cooling system. If the load bank is positioned with the prevailing wind opposing the airflow from the blower, inadequate cooling may result and damage to the load bank can occur.

#### **SAFETY:**

**DO NOT TOUCH THE TOP EXHAUST SCREEN DURING OPERATION. THE SCREEN WILL BECOME HOT FROM THE EXHAUST HEAT AND CAN CAUSE A SERIOUS BURN.**

### Step 2: Ground the load bank.

A permanent ground conductor must be connected to the load bank enclosure. The ground stud must be connected to the same earth ground as the generator. This will bond the generator and load bank grounds together. The ground wire should be at least a No. 6 AWG or sized per the National Electric Code Section 250 if not directed by local code.

### Step 3: Connect load terminals.

It is of the utmost importance to make sure the load connections are connected properly and tight. For example, if your blower motor is running backwards your phases are reversed and must be corrected. (On most load bank there is a switch you can actuate to correct this problem).

### Step 4: Set up voltage.

Many load banks are dual voltage, so it is important to ensure your generator and load bank are set up for the same voltage (i.e. 120/208 or 240/480 vac). Ensure the voltage selector switch is in the proper position before applying load to the generator.

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**SAFETY:**

**DO NOT OPERATE THE LOAD BANK OVER THE RATED VOLTAGE. THIS WILL CAUSE CATASTROPHIC LOAD BANK FAILURE**

**Step 5: Operate the load bank.**

- With the generator properly connected and operating, close the generator load contactor and place the load bank power switch to the ON position; a pilot light will illuminate indicating that control power is present.
- Place the blower switch to the ON position, note that the blower failure indicator flashes momentarily, when the blower motor has reached proper operating speed the blower failure indicator will de-energize.
- Place the master load switch in the ON position, the load can now be applied to the generator.
- The resistive load is applied to the generator by actuating toggle switches. You can select a variety of load combinations using the toggle switches to obtain the desired load.
- Operate the generator at 100% load for a period of 1 hour
- Observe generator conditions and performance
- Log all required observations and readings on the appropriate forms or logs

**Step 6: Shut down the load bank.**

- Remove all the load from the generator by placing the load toggle switches to the off position.
- Place the master load switch to the off position.
- Allow the load bank to operate for a 15 minute cool down period without load.
- Place the power switch to the off position, and all other switches on the control panel should be off.
- Open load breaker on the generator
- Shut down the generator.
- Disconnect the load bank from the generator and secure all access doors.

**HINT:**

It is good policy to allow the fan blower motor to operate for about 15 minutes after load is removed.

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**Review Questions**  
**for**  
**Test Generator Sets Using Load Bank**

<b>Question</b>	<b>Answer</b>
1. What can happen if the load bank is positioned with the wind opposing the airflow?	a. Inadequate cooling and damage to the load bank b. Wind will have no effect on the load bank c. Wind can help cool the load bank d. The load bank will blow over
2. The generator and load bank are not connected to a common ground.	a. True b. False
3. Why must the load bank and the generator have the same voltage?	a. To parallel together b. If they are not the same, they will be out of phase c. If they are not the same, you may burn up the load bank d. If the load bank is dual voltage, it will not make a difference
4. What order do you operate the switches of the load bank?	a. Master load switch, power switch, blower switch b. Blower switch, master load switch, power switch c. Power switch, blower switch, master load switch d. All three switches at the same time
5. How many minutes should the blower fan operate after the load is removed?	a. 3 b. 5 c. 10 d. 15

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**TEST GENERATOR SETS USING LOAD BANK**

Performance Checklist		
Step	Yes	No
Did Trainee:		
1. Positioned the load bank		
2. Grounded the load bank		
3. Connected load terminals		
4. Set up the voltage		
5. Operated the load bank		
6. Shut down the load bank		

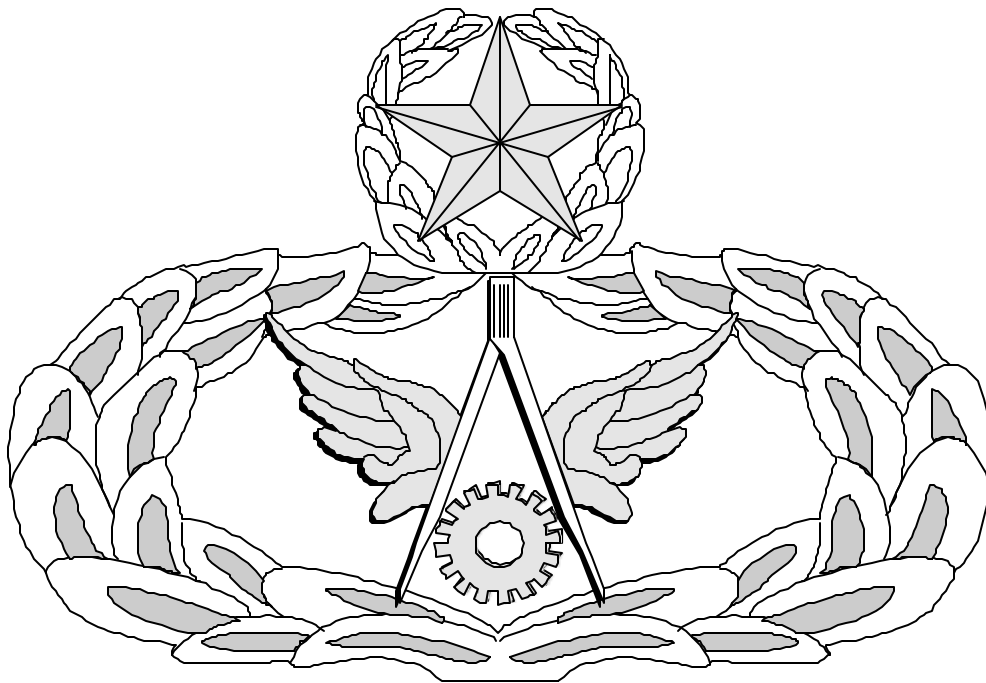
**FEEDBACK:** Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

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# Air Force Civil Engineer

## QUALIFICATION TRAINING PACKAGE (QTP)

### REVIEW ANSWER KEY



For  
ELECTRICAL POWER PRODUCTION

(3E0X2)

### MODULE 28

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**MAINTAIN POWER PLANT DOCUMENTATION****(3E0X2-28.8)**

<b>Question</b>	<b>Answer</b>
1. Power plant documentation is standard for all power plants throughout the Air Force?	b. False
2. Why is good record keeping essential to equipment analysis?	d. Both a and b
3. What is the importance or reason for maintaining generator operating logs?	a. Record performance during operation, inspection, and testing
4. Which form is used for standby plants or RPIE and EAID generators requiring bi-hourly monitoring?	c. AF Form 487, Emergency Generator Operating Log
5. Which form should be maintained for each RPIE and EAID generator for the purpose of documenting engine hours and maintenance performed?	a. AF Form 719, Historical Record Diesel Electric Generators

**CONNECT****(3E0X2-28.9.1)**

<b>Question</b>	<b>Answer</b>
1. You have been tasked to install a generator at bldg.111. What is the first thing you should do?	d. Both b&c.
2. What step must be taken prior to connecting leads to the load terminal board of a MEP 005A?	c. Remove safety cover
3. Load cables should always be installed through generator access doors.	b. False
4. It is safe to install MEP 007 load cables by hand if generator is off.	a. True
5. You have just finished installing the load cables between the generator and the facility, what	c. Check for proper phase sequence

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should be your next step?	
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**DISCONNECT****(3E0X2-28.9.2)**

<b>Question</b>	<b>Answer</b>
1. Who is primarily responsible for connecting and disconnecting the load cables at EAID sites?	a. Power Pro. personnel
2. What must be verified prior to disconnecting the load leads?	d. a & c
3. When is it safe to disconnect load cables when the unit is operating?	d. It is never safe
4. What two types of voltage checks are made to ensure the load terminals are not energized on a MEP-007A?	a. Phase and Line

**TEST GENERATOR SETS USING LOAD BANK****(3E0X2-28.10)**

<b>Question</b>	<b>Answer</b>
1. What can happen if the load bank is positioned with the wind opposing the airflow?	a. Inadequate cooling and damage to the load bank
2. The generator and load bank are not connected to a common ground.	b. False
3. Why must the load bank and the generator have the same voltage?	c. If they are not the same, you may burn up the load bank
4. What order do you operate the switches of the load bank?	c. Power switch, blower switch, master load switch
5. How many minutes should the blower fan operate after the load is removed?	d. 15

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